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The Standard Model of Particle Physics

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Introduction

The Standard Model of Particle Physics is one of the greatest achievements of 20th Century physics. Perhaps this is most eloquently expressed by the fact that almost our entire understanding of nature at a fundamental level can be represented on a few pages of the Particle Data Pocket Handbook. Still, this is no more useful than a set of hieroglyphics unless one knows what the symbols mean and possess the arcane rites required to materialise useful numbers.

Moreover the Standard Model is just that: a model, built on the guiding principles of 'spontaniously broken gauge theory'. Neutrino mass, recently confirmed, is not a part of it so necessitating the construction of extensions. 'Renormalizability' is also a guiding principle of the Standard Model, however renormalization theory has evolved considerably since its inception and so called 'effective field theory' allows one to not only bridge the gulf between strong interactions as encoded in the Standard Model and low energy hadron phenomenology but also incorporate gravity under its banner.

The aim of this course is to compactly

present the Standard Model in this general context. At its conclusion you should be able to write down a model with prescribed symmetry, quantize it (meaning obtain the associated 'Feynman rules') and calculate its consequences (cross-sections etc). The only prerequisites are the big three - Classical Mechanics, Classical Electrodynamics and Quantum Mechanics at the Honours level. Such necessities as group theory (to talk the talk) and path integrals (to random walk the walk) are developed in the text, albeit a street knowledge of particle physics is useful. Each section ends with a set of exercises which <u>are</u> essential to developing competency as opposed to literacy.